MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU - SHENZHEN - HONG KONG EXPRESS RAIL LINK

(No. EP-349/2009B)

Contingency Plan for Groundwater Level

(Contract 822 – Tse Uk Tsuen to Shek Yam Tunnels)

Certified by: Glenn Frommer

Position: Environmental Team Leader

Date: 11-5-2011

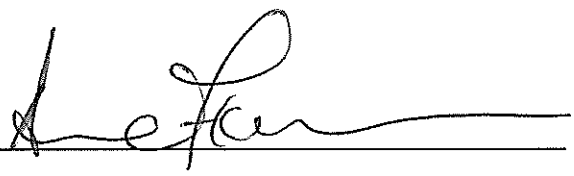
MTR Corporation Limited

HONG KONG SECTION OF GUANGZHOU - SHENZHEN - HONG KONG EXPRESS RAIL LINK

(No. EP-349/2009B)

Contingency Plan for Groundwater Level

(Contract 822 – Tse Uk Tsuen to Shek Yam Tunnels)

Verified by: 

Position: Independent Environmental Checker

Date: 13 May 2011

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H2538 – MTR/XRL822

Contingency Plan for Groundwater Level

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The Construction Manager (Tunnels) is responsible for updating and maintaining the plan, including the original hard copy, which should be signed by the Project Director to indicate approval.

The status of this plan is identified by a revision number and date on each page. Changes to the document are identified by a vertical single line in the right-hand margin. On revision, the plan will be uploaded as a whole to the project server or within the Leighton Asia Document Management System Technical Documents Module. The Quality and Environment Manager maintains a record of the revision status of the plan, which is available on request.

If you have any enquiry relating to this plan, please contact the Construction Manager (Tunnels).

Revision History and Plan Approval

Revision	Date	Prepared by:	Checked by	Approved by:	Section/Description
00	31-Jul-10	Gordon Leslie	Dale Pugh	Ray Brewster	Draft for comment.
01	18-Aug-10	Gordon Leslie	Dale Pugh	Ray Brewster	Initial issue.
02	25-Sep-10	Gordon Leslie	Brian Pickering	Dale Pugh	MTR comments included
03	30-Oct-10	Gordon Leslie	Dale Pugh	Ray Brewster	Revised Sections 3 and 4, Added Appendix 3

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1 Introduction

In accordance with section 10 of the Environmental Impact Assessment Ordinance, the Director of Environmental Protection (the Director) has granted an Environmental Permit (EP-349/2009) to the MTR Corporation Limited (Permit Holder) for the construction and operation of the Hong Kong Section of the Guangzhau – Shenzhen – Hong Kong Express Rail Link.

Part C of the Environmental Permit contains a number of conditions that must be complied with by Permit Holder and all other parties working on the project. One such permit condition is Special Condition 2.11 which states:-

> "Before the commencement of any tunnelling or soil excavation works, the Permit Holder shall deposit with the Director a contingency plan to deal with any unforeseeable incidents which might affect the groundwater level."

Leighton Contractors (Asia) Limited were awarded a contract (XRL822) by MTR to construct the Tse Uk Tsuen to Shek Yam Tunnels and associated works which includes:

1. 7.35 km of twin track rail tunnels;
2. 0.6 km of single track rail tunnels;
3. 0.5 km of construction adit at Shek Yam (works area H);
4. a ventilation building with two adits at Pat Heung (works area F);
5. a ventilation building and shaft at Shing Mun (works area G);
6. two explosive magazines [at So Kwun Wat (works area AC) and Tai Shu Ha (works area AE)];
7. a barging facility at Tsing Chau Tsai (works area AG); and
8. site offices at Kwai Chung (works area K).

Accordingly, this contingency plan has been prepared to fulfil the requirement of the Environmental Permit Special Condition in respect of contract XRL822 (see Appendix 1 for the General Layout Plan).

2 Contingency Plan for Control of Groundwater Level

2.1 General

This contingency plan for control of groundwater level is to be submitted for the Engineer's approval and implemented by the Contractor. This plan comprises response actions to be taken (by the Contractor) in the event that defined groundwater drawdown levels are reached.

2.2 Groundwater Control Measures - Grouting

Groundwater drawn down due to tunneling shall be controlled through both pre-excavation and post-excavation grouting. By meeting all water inflow criteria in the tunnel, the groundwater level shall remain within an acceptable level.

In order to gain a better understanding of potential water inflow, prior to any excavation being carried out in the tunnel, at least three probe holes will be drilled in advance of the face. If the trigger criterion of >5 litres per minute in any one hole, or a total of >10 litres per minute in more than one hole measured over a minimum length of 20m is reached at least one hour after the completion of drilling, grouting of the affected zone will commence. Permanent

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grouting crews will be available with dedicated equipment at both Shek Yam and Pat Heung locations to deal with any trigger criteria.

After grouting, control holes will be drilled and the water inflow measured against the same trigger criteria. Re-injection may be necessary depending on the results of testing in any control holes and compliance with the nominated limits. If re-injection is required it can be carried out using the same procedure as for initial grouting. Re-injection may then be followed by further control holes, and further injection stages as necessary, until the desired outcome is achieved.

Probe holes will provide advance warning of any unforeseeable conditions that may lead to unacceptable groundwater drawdown before the tunnel encounters it.

Following excavation but before the permanent lining is installed, water inflow will be controlled to below 50 litres per minute measured over a 25m section. Localized post-excavation grouting will be used when this trigger criteria is met.

For the completed (lined) tunnel, groundwater inflow shall not exceed 400 litres per minute for 1000m of completed tunnel. Where this criterion is triggered, localized post-excavation grouting will commence. This grouting will continue until the final groundwater inflow criteria are met.

By meeting all water inflow criteria in the tunnel, unforeseeable incidents affecting the groundwater level can be avoided.

3 Response Levels

Monitoring data shall be interpreted against Alert, Action and Alarm levels (collectively referred as Response Levels). The Response Levels are defined as follows:

3.1 Alert Level

This is the lowest response value that signifies the reading at which closer attention needs to be paid to the monitoring levels in that area. When the "Alert Level" value is reached, remedial measures shall be documented and agreed.

3.2 Action Level

This is the intermediate response value that signifies the reading at which response action is mandatory. When the "Action Level" value is reached, the previously documented and agreed remedial measures shall be implemented.

3.3 Alarm Level

This is the highest response value that signifies the level that shall not be exceeded. When the "Alarm Level" is reached, the associated works may be suspended by the Engineer.

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4 Reporting of Monitoring Results

4.1 Monitoring Instrumentation

The contractor is responsible for carrying out monitoring of the groundwater levels.

A list of proposed and existing groundwater monitoring locations for XRL 822 is attached in Appendix 2 and the associated location plans are included in Appendix 3. Standpipes and piezometers will have the following minimum frequency of monitoring (except for VB4 and VB5) :

Type of Monitoring	Frequency
Background Monitoring	Weekly
Standard Monitoring	Weekly
Active Monitoring	Daily

In the case of VB4 and VB5 the minimum frequency will be as follows:

Type of Monitoring	Frequency
During Wall Installation	Weekly
During Excavation	Daily
Prior to Backfilling to Ground Level	Twice a Week

The frequency of monitoring shall be increased as necessary or as instructed by the engineer. In addition, an Independent Monitoring Contractor employed by MTR will carry out independent monitoring at an agreed frequency as well as joint monitoring with the Contractor.

4.2 Reporting on Monitoring Results

A web-based reporting system for all the readings of the instrument installed in the project will be set up by the Employer's Independent Monitoring Contractor. The web-based reporting system will automatically generate message to stakeholders if a response level is reached. The Contractor will upload the instrumentation readings of all routine and joint monitoring results on the web-based reporting system directly. The Contractor will also prepare a contingency plan to inform stakeholders when response level is reached, in the event of the web-based reporting system has mal-functioned.

The Contractor will submit weekly monitoring and interpretation reports to the Engineer and the Employer's Independent Monitoring Contractor in accordance with the requirements of the contract. The format of the report shall be agreed with the Engineer. The Contractor will interpret the monitoring data with consideration of the construction activity and other events which might cause changes to the instrumentation data and evaluate monitoring data to determine whether the responses to construction activities and any other events are reasonable. The Engineer's Independent Monitoring Contractor will check the Contractor's monitoring and interpretation reports and incorporate the interpretation and the joint monitoring results into his own reports and submit to the Engineer with a copy to the Contractor.

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5 Procedure for Alert, Action and Alarm Level Exceedence

Groundwater levels shall be monitored against the alert, action and alarm levels as shown in table 5.1.

The actions to be implemented when the Response Levels are reached are referred as Response Actions. The response actions initially may comprise passive action such as additional monitoring, but typically will be active measures taken by the Contractor to vary his construction activities to diminish the deformation. When an Alarm level is reached, emergency actions will be implemented.

5.1 Contingency Actions for Groundwater Response Level

The response actions for different levels of groundwater drawdown are summarized in the following tables:

Table 5.1 – Proposed Actions for Response Levels for ELS Groundwater Drawdown

Response Level	Response Value	Proposed Minimum Action to be Taken
Alert level	500mm below the lowest historical groundwater level	• Inform the Engineer within 24 hours; • Investigate whether the triggering of response level is related to construction works; • Prepare Detailed Plan of Action and submit to Engineer within 72 hours when instructed by the Engineer, and • Implement Response Actions identified in the Detailed Plan of Action for reaching Alert Level, which may include but not limited to: ○ Review and increase instrument monitoring frequency, if applicable ○ Review prediction model and construction activity to ensure the groundwater drawdown is in line with expected results.
Action level	800mm below the lowest historical groundwater level	• Investigate whether the triggering of response level is related to construction works; • Implement the Response Actions for reaching Action Level in accordance with the Detailed Plan of Action, which may include but not limited to: ○ Review and propose additional monitoring, if applicable ○ Prepare and submit an updated review on the groundwater drawdown ○ Perform Design Review ○ Propose precautionary measures to limit further dewatering in associated with the ELS works and

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Response Level	Response Value	Proposed Minimum Action to be Taken
		limit further drawn down in groundwater table. • Meet the Engineer to discuss the instrument response and review the effective of the Levels. Make appropriate amendments to the Detailed Plan of Action; • Undertake additional measures in the affected area to avoid reaching the Alarm level which may includes but limited to recharging the groundwater, and • Prepare and submit the details of Emergency Response Actions for reaching the Alarm Level.
Alarm level	1000mm below the lowest historical groundwater level	• Notify the Engineer and to discuss the need for Emergency Response Action; • Investigate whether the triggering of response level is related to construction works; • Implement emergency Response actions, which may include but not limited to: ○ Suspension of activities in the affected area with the exception of those necessary actions to diminish the groundwater drawdown ○ Implement action to prevent further groundwater drawdown. • Submit a complete report to the Engineer to examine the construction method and to review groundwater response history and the Response Actions to be taken related to the construction sequences within the timeframe decided by the Engineer, and • Works activities shall not be resumed without the approval of the Engineer after demonstrating it is safe to resume works.

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Appendix 1 General Layout Plan - Drawing No. 822/K/360/LCA/T01/1001-A

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KEY LOCATION PLAN

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DESIGNED	GL
CHECKED	BP
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DATE	18AUG2010

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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
CIVIL WORKS
PLAN AND PROFILE
KEY PLAN

SCALE 1 : 10000 (A1)

DRAWING NO. 822/K/360/LCA/T01/1001

REV. A

Appendix 2 List of all Groundwater Monitoring Locations for XRL 822

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List of Groundwater Monitoring Stations *(at end Sept.10)*

Groundwater Monitoring Station Reference		Downtrack Chainage or Location Area
Existing	Proposed	
---	PGWMP - 1	132+049
---	PGWMP – 2	132+079
---	PGWMP – 3	132+051
---	PGWMP – 4	132+089
---	PGWMP – 5	132+067
---	PGWMP – 6	PHV
---	PGWMP – 7	PHV
---	PGWMP – 8	PHV
---	PGWMP – 9	PHV
---	PGWMP – 10	PHV
---	PGWMP – 11	132+648
LV1	---	125+358
LV2	---	125+375
LV3	---	PHV
LV4	---	PHV
LV4a	---	PHV
LV5	---	SKW
F005	---	125+398
D383	---	125+665
F007	---	125+690
A031n	---	125+868
B004a	---	126+150
A031b	---	126+895
A031c	---	127+121
A031d	---	128+493
A031e	---	129+286
A031f	---	129+965
A031j	---	130+240
A031g	---	130+846
D361	---	132+062
A033c	---	132+066
A033	---	132+096
C004	---	132+162
B005	---	132+356
D356	---	132+538

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Groundwater Monitoring Station Reference		Downtrack Chainage or Location Area
Existing	Proposed	
A036	---	132+730
D350	---	132+835
D348	---	132+906
D364	---	131+886
C002a	---	PHV
C002b	---	PHV
C002c	---	PHV
C002d	---	PHV
C002e	---	PHV
D387	---	PHV
D388	---	PHV
C002f	---	125+882
C002g	---	125+715
C003	---	125+710
A080	---	SKW
A082	---	SKW
D352	---	SYA
D354	---	SYA

Legend:
PGWMP = Proposed Groundwater Monitoring Point;
PHV = Pat Heung Ventilation site;
SKW = So Kwun Wat magazine site;
SYA = Shek Yam Area

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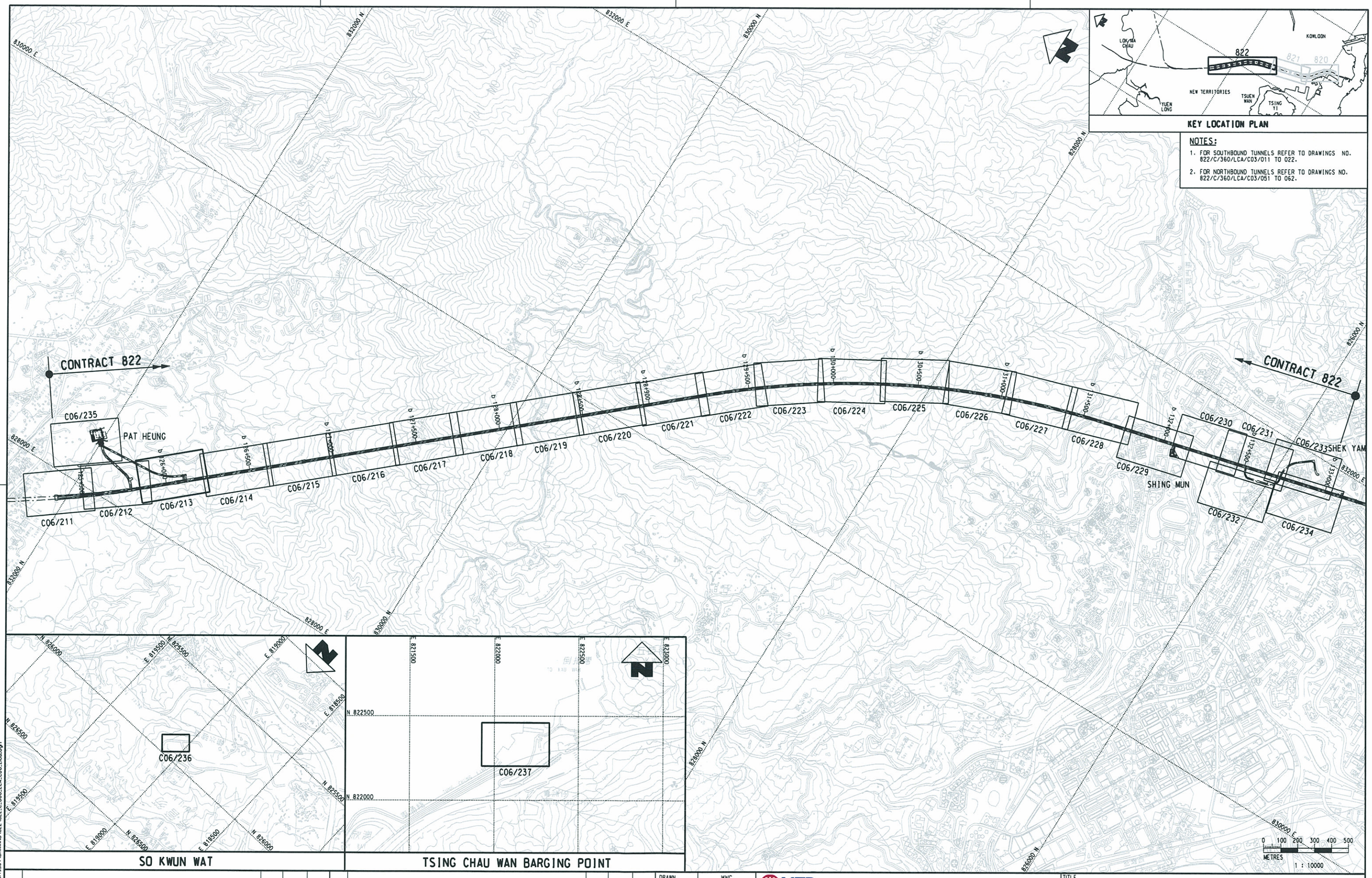
Appendix 3 Groundwater Monitoring Location Plans

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List of Instrumentation Monitoring Location

Drawing No.	Rev.	Title
822/C/000/LCA/C06/210	B	Drawing Index Plan – Instrumentation and Monitoring
822/C/000/LCA/C06/211	B	Instrumentation and Monitoring (Sheet 1 of 27)
822/C/000/LCA/C06/212	C	Instrumentation and Monitoring (Sheet 2 of 27)
822/C/000/LCA/C06/213	B	Instrumentation and Monitoring (Sheet 3 of 27)
822/C/000/LCA/C06/214	B	Instrumentation and Monitoring (Sheet 4 of 27)
822/C/000/LCA/C06/215	B	Instrumentation and Monitoring (Sheet 5 of 27)
822/C/000/LCA/C06/216	B	Instrumentation and Monitoring (Sheet 6 of 27)
822/C/000/LCA/C06/217	C	Instrumentation and Monitoring (Sheet 7 of 27)
822/C/000/LCA/C06/218	B	Instrumentation and Monitoring (Sheet 8 of 27)
822/C/000/LCA/C06/219	B	Instrumentation and Monitoring (Sheet 9 of 27)
822/C/000/LCA/C06/220	B	Instrumentation and Monitoring (Sheet 10 of 27)
822/C/000/LCA/C06/221	B	Instrumentation and Monitoring (Sheet 11of 27)
822/C/000/LCA/C06/222	B	Instrumentation and Monitoring (Sheet 12 of 27)
822/C/000/LCA/C06/223	B	Instrumentation and Monitoring (Sheet 13 of 27)
822/C/000/LCA/C06/224	B	Instrumentation and Monitoring (Sheet 14 of 27)
822/C/000/LCA/C06/225	B	Instrumentation and Monitoring (Sheet 15 of 27)
822/C/000/LCA/C06/226	B	Instrumentation and Monitoring (Sheet 16 of 27)
822/C/000/LCA/C06/227	B	Instrumentation and Monitoring (Sheet 17 of 27)
822/C/000/LCA/C06/228	B	Instrumentation and Monitoring (Sheet 18 of 27)
822/C/000/LCA/C06/229	C	Instrumentation and Monitoring (Sheet 19 of 27)
822/C/000/LCA/C06/230	B	Instrumentation and Monitoring (Sheet 20 of 27)
822/C/000/LCA/C06/231	D	Instrumentation and Monitoring (Sheet 21 of 27)
822/C/000/LCA/C06/232	D	Instrumentation and Monitoring (Sheet 22 of 27)
822/C/000/LCA/C06/233	E	Instrumentation and Monitoring (Sheet 23 of 27)
822/C/000/LCA/C06/234	D	Instrumentation and Monitoring (Sheet 24 of 27)
822/C/000/LCA/C06/235	C	Instrumentation and Monitoring (Sheet 25 of 27)
822/C/000/LCA/C06/236	D	Instrumentation and Monitoring (Sheet 26 of 27)
822/C/000/LCA/C06/237	D	Instrumentation and Monitoring (Sheet 27 of 27)

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REV	DESCRIPTION	BY	DATE	APPROVED
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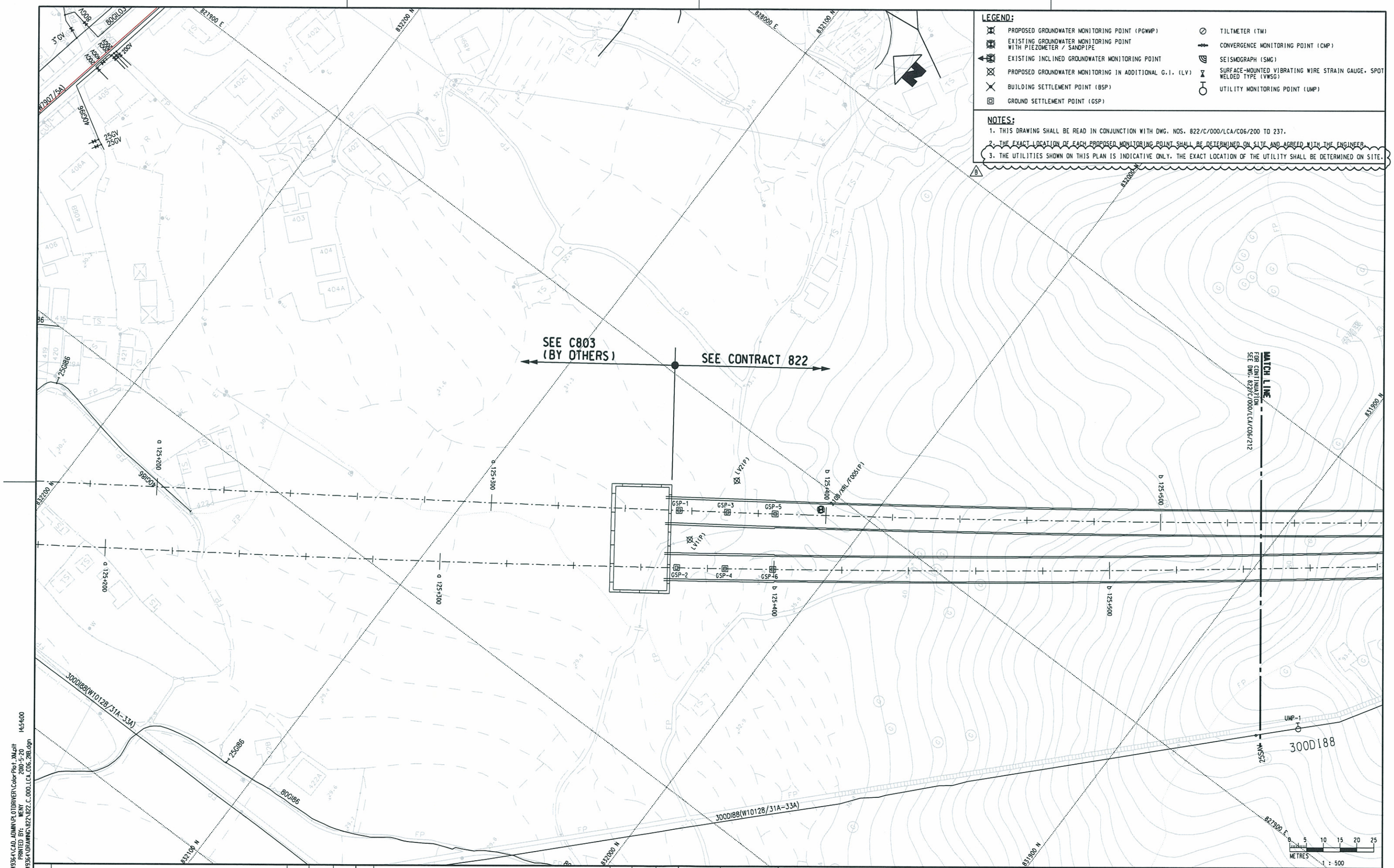
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
DRAWING INDEX PLAN - INSTRUMENTATION AND MORITORING

SCALE 1 : 10000 (A1)

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REV. B

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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 1 OF 27)

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LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

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THE PROPOSED INSTRUMENTATION FOR SHEUNG TSUEN FRESH WATER BALANCE TANK (WTO37) SHALL BE AGREED WITH WSD

MATCH LINE - FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/211

MATCH LINE - FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/213

2108/XRL/C0029

2108/XRL/C0031(P)

2108/XRL/A031in(P)

2108/XRL/D383(P)

2108/XRL/F0071(P)

GSP-11

GSP-9

GSP-8

UMP-1

UMP-2

b 125+600

b 125+700

b 125+800

b 125+900

831900 N

831800 N

831700 N

831600 N

828000 E

828100 E

828200 E

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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 2 OF 27)

SCALE	DRAWING NO.	REV.
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- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

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THE PROPOSED INSTRUMENTATION FOR TAI LAM CHUNG TUNNEL IS SUBJECTED TO ACCESS CONDITION AND AGREEMENT WITH WSD.

LUI KUNG TIN PORTAL (TP070)

2108/ARL/A031n(P)

2108/ARL/B004s(P)

CMP-4

VWSG-4

CMP-5

VWSG-5

TAI LAM CHUNG CATCHWATER ABC TUNNEL 12A (WB102/10A & WB108.01.44)

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MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/214

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828400 E

828500 E

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831600 N

831500 N

831400 N

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b 126+000

b 126+100

b 126+200

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1 : 500

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 禮頓 AECOM

CADD REF. 822_C_000_LCA_C06_213B.dgn

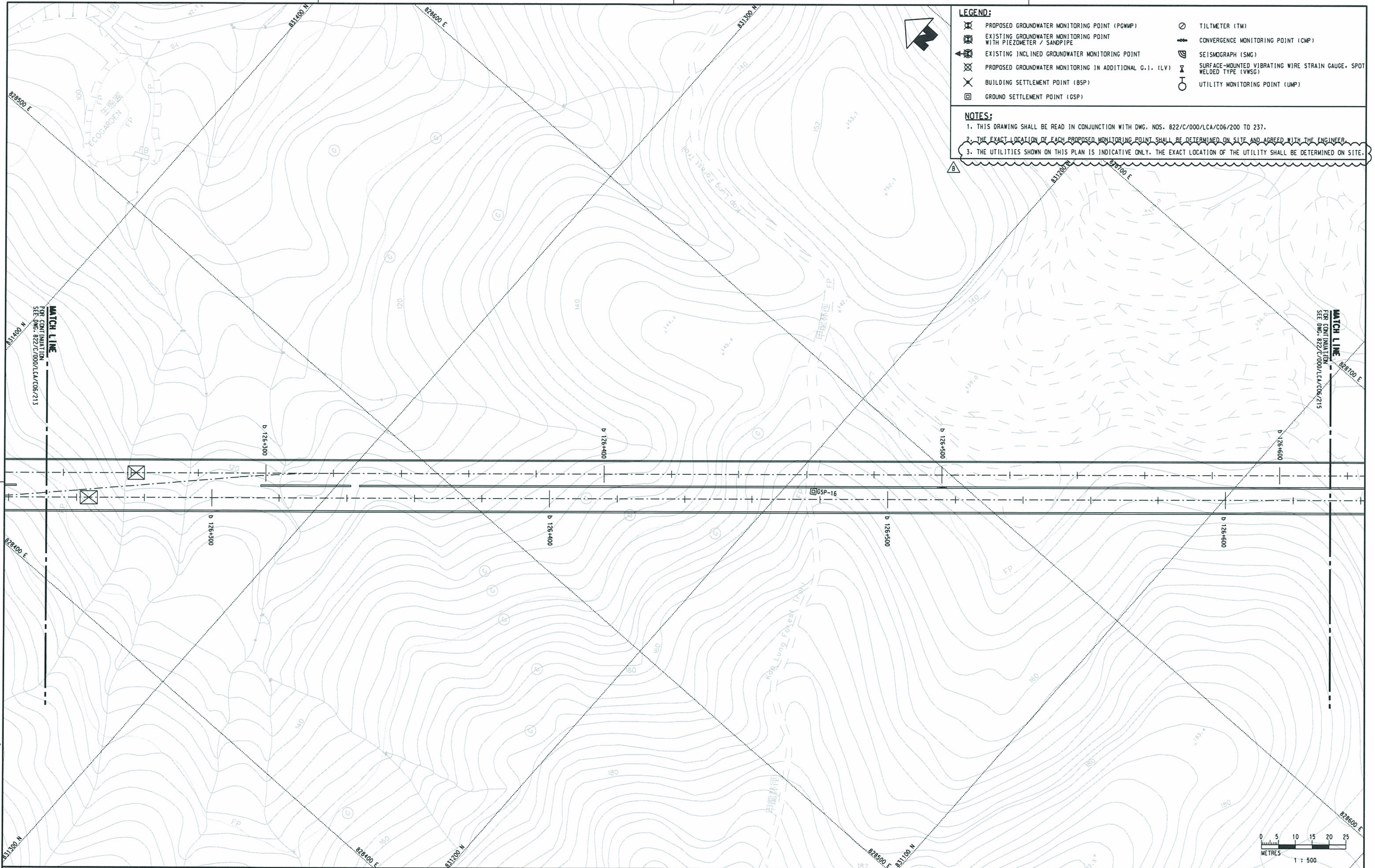
TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 3 OF 27)

SCALE 1 : 500 (A1)

DRAWING NO. 822/C/000/LCA/C06/213

REV. B



LEGEND:

	PROPOSED GROUNDWATER MONITORING POINT (PGWMP)		TILTMETER (TM)
	EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE		CONVERGENCE MONITORING POINT (CMP)
	EXISTING INCLINED GROUNDWATER MONITORING POINT		SEISMOGRAPH (SMG)
	PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)		SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
	BUILDING SETTLEMENT POINT (BSP)		UTILITY MONITORING POINT (UMP)
	GROUND SETTLEMENT POINT (GSP)		

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

B

REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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ORIGINATOR

LEIGHTON 禮頓 AECOM

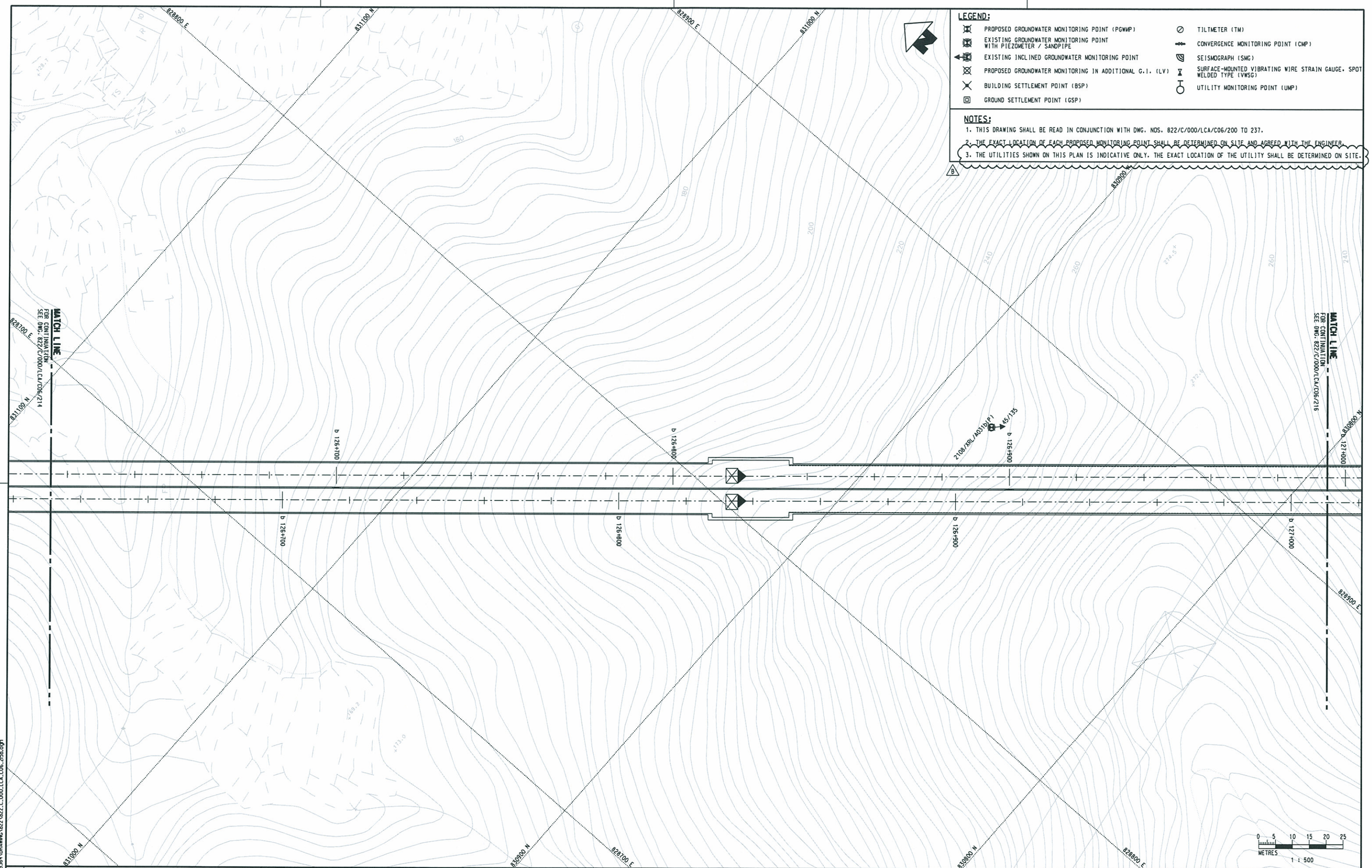
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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 4 OF 27)

SCALE 1 : 500 (A1) | DRAWING NO. 822/C/000/LCA/C06/214 | REV. B

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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LEIGHTON 德拔 AECOM

CADD REF. 822_C_000_LCA_C06_215B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 5 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/215	B

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2008-5-20
1455d5

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

8

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/215

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/217

2108/ARL/A03(cIP)

METRES 0 5 10 15 20 25

1 : 500

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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ORIGINATOR

LEIGHTON 禮頓 AECOM

CADD REF. 822_C_000_LCA_C06_216B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 6 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/216	B

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/216

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/218

GSP-17

METRES 0 5 10 15 20 25

1 : 500

REV	DESCRIPTION	BY	DATE	APPROVED
C	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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ORIGINATOR

LEIGHTON 香港 AECOM

CADD REF. 822_C_000_LCA_C06_217C.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 7 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/217	C

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LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

829500 E
830300 N
829600 E
830200 N
830100 N
829700 E
830000 N
829400 E
829800 E
829900 E
830100 N
830200 N
829400 E
830000 N
829500 E
829600 E

MATCH LINE
FOR CONTINUATION
SEE DWG. 822/C/000/LCA/C06/217

MATCH LINE
FOR CONTINUATION
SEE DWG. 822/C/000/LCA/C06/219

b 127+800
b 127+900
b 128+000
b 128+100

Boulder(s)

0 5 10 15 20 25
METRES
1 : 500

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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ORIGINATOR

LEIGHTON 利頓 AECOM

CADD REF. 822_C_000_LCA_C06_218B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 8 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/218	B

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/218

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/220

GSP-19

METRES 0 5 10 15 20 25

1 : 500

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 德祐 AECOM

CADD REF. 822_C_000_LCA_C06_219B.dgn

TITLE

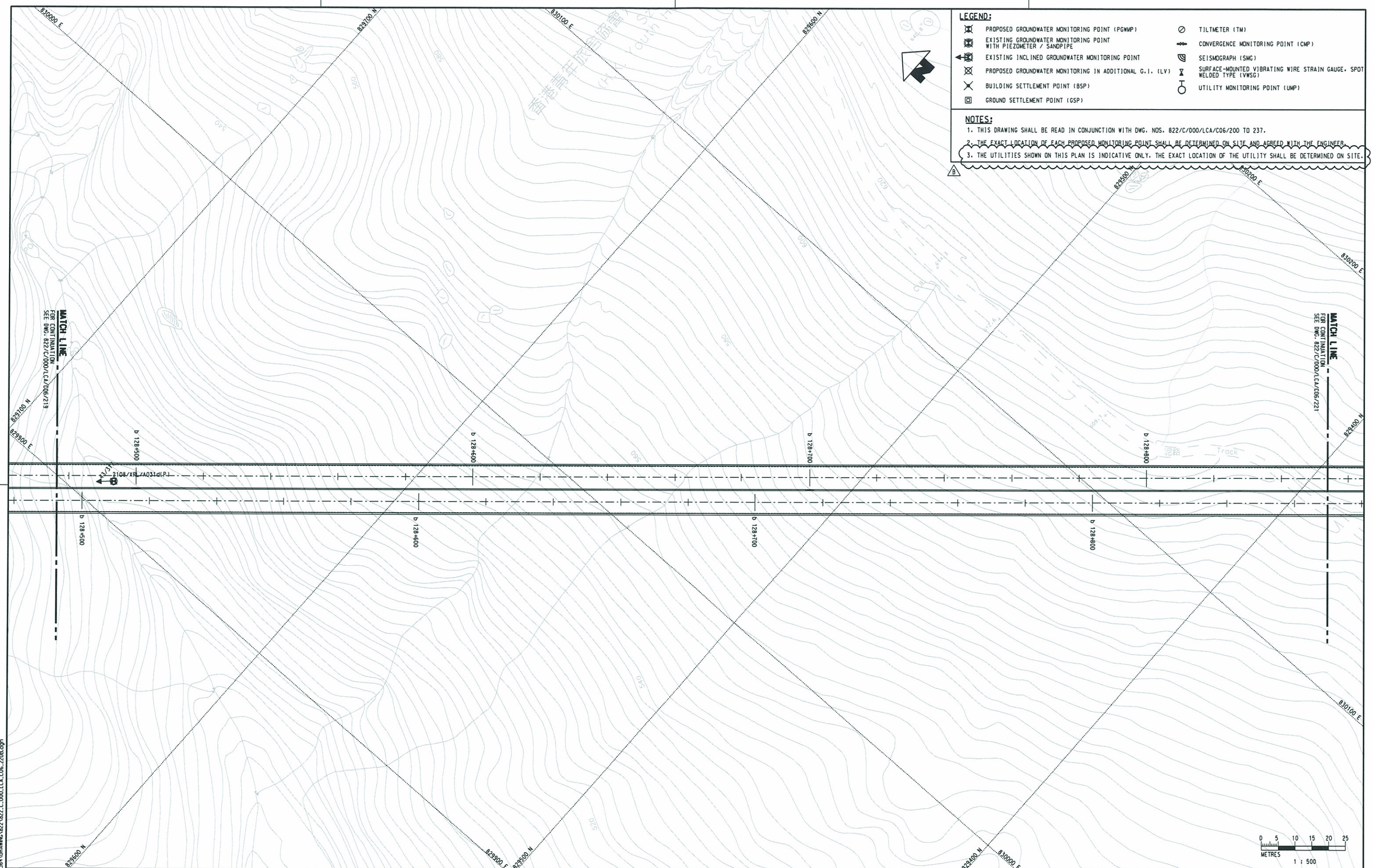
CONTRACT 822

TSE UK TSUEN TO SHEK YAM TUNNELS

INSTRUMENTATION AND MONITORING PLAN

(SHEET 9 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/219	B



LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

DO NOT SCALE DRAWINGS. ALL DIMENSIONS SHALL BE VERIFIED ON SITE.
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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 利德 AECOM

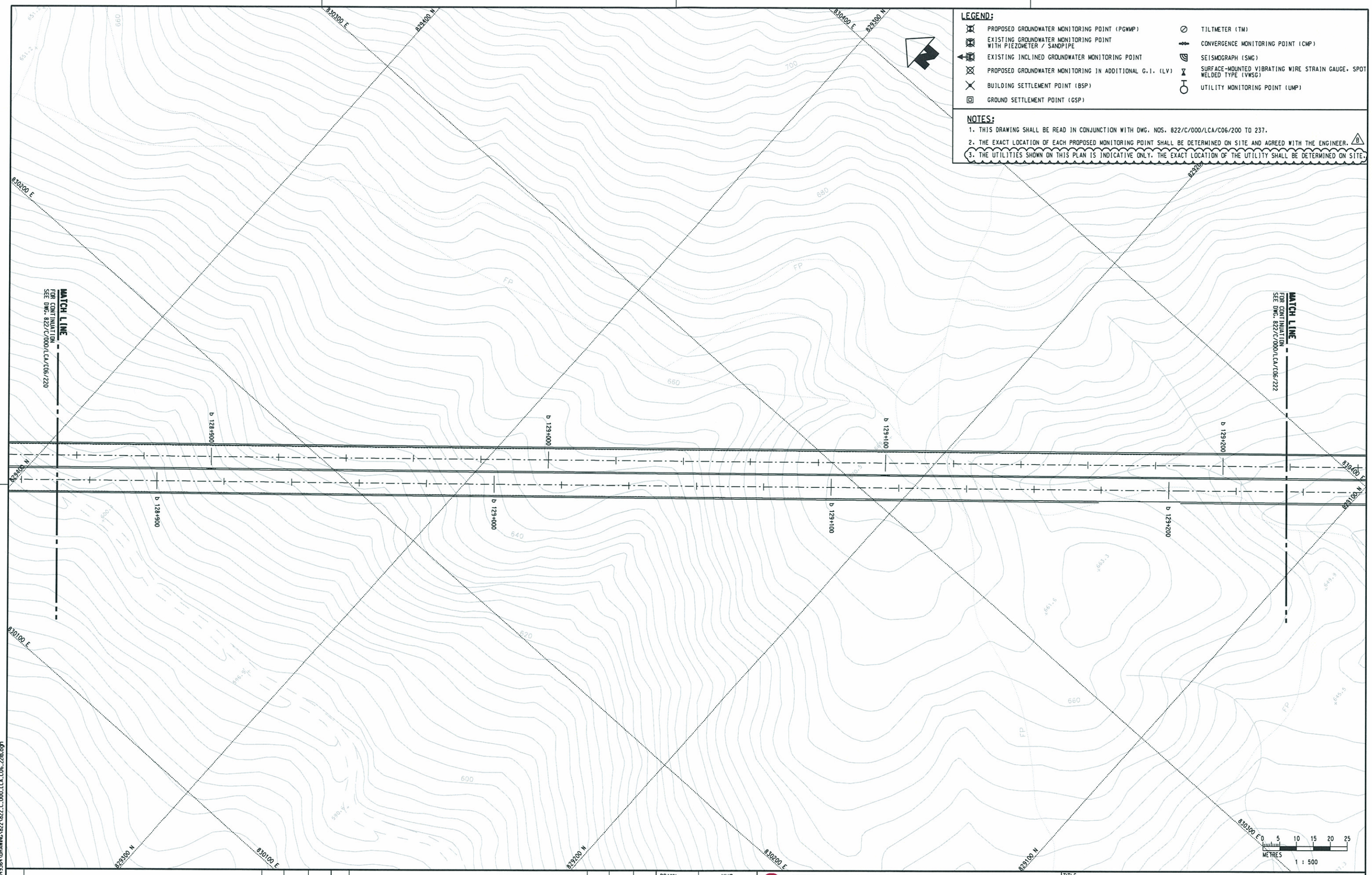
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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 10 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/220	B

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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ORIGINATOR

LEIGHTON 利德 AECOM

CADD REF. 822_C_000_LCA_C06_221B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 11 OF 27)

SCALE 1 : 500 (A1)

DRAWING NO. 822/C/000/LCA/C06/221

REV. B

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FILENAME: P:\PROJECTS\6804936\DRAWINGS\822\C_000_LCA_C06_221B.dgn
PRINTED BY: WENY
200-5-20 14:57:04

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER. B
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/221

MATCH LINE FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/223

2108/XRL/A031e(P)
45/225

b 129+200
b 129+300
b 129+400
b 129+500
b 129+600

830500 E
829100 N
829000 N
828900 N
830400 E
830600 E
828800 N

0 5 10 15 20 25
METRES
1 : 500

REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 怡切 AECOM

CADD REF. 822_C_000_LCA_C06_222B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 12 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/222	B

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Default
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200-5-20
145709
P:\PROJECTS\6014936\CAD_ADMIN\PLOTDRIVER\ColorPlot_XW.plt

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER. B
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

MATCH LINE
FOR CONTINUATION
SEE DWG. 822/C/000/LCA/C06/222

MATCH LINE
FOR CONTINUATION
SEE DWG. 822/C/000/LCA/C06/224

METRES 0 5 10 15 20 25
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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

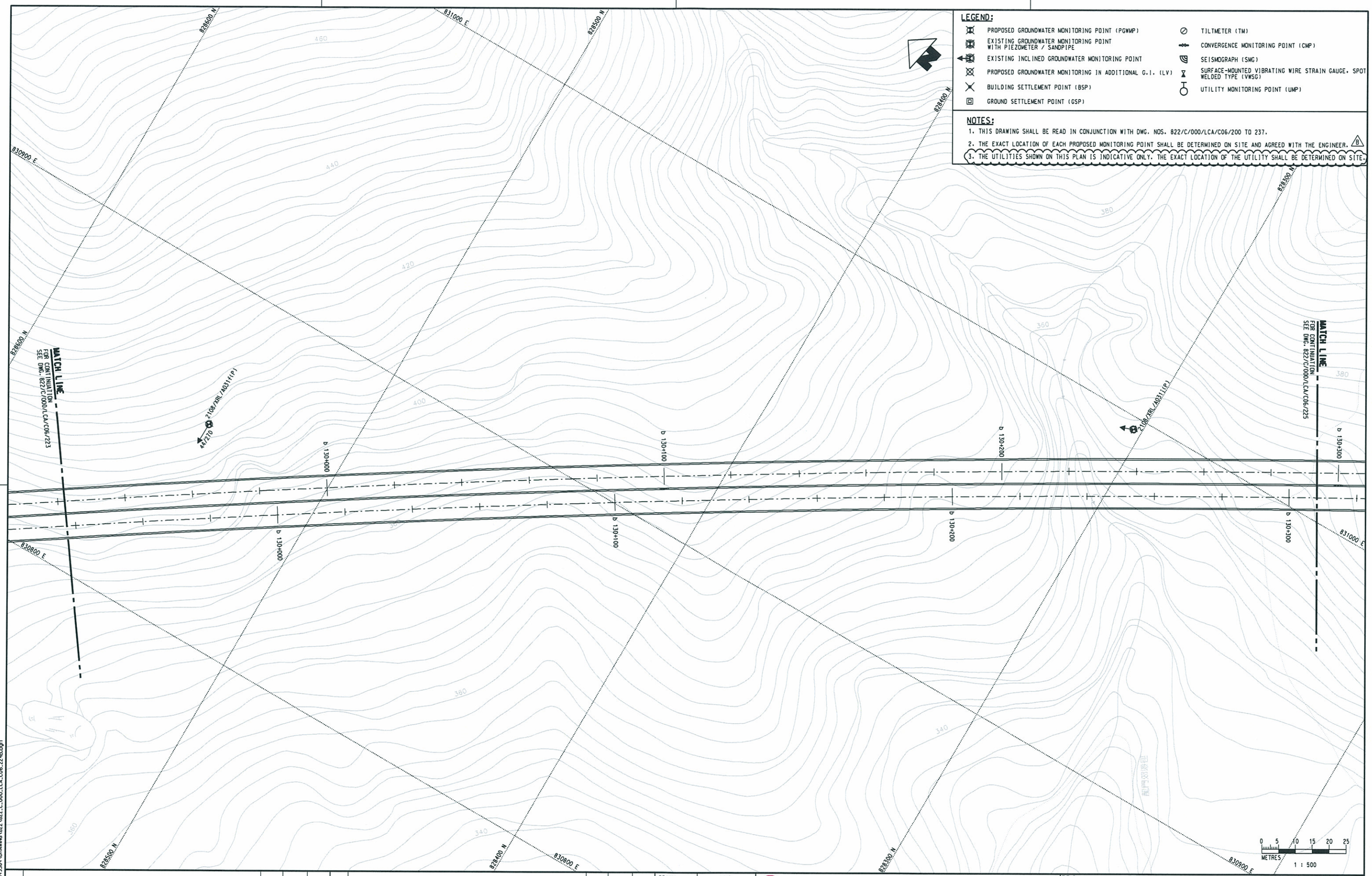
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EXPRESS RAIL LINK
ORIGINATOR
LEIGHTON 禮頓 AECOM
CADD REF. 822_C_000_LCA_C06_223B.dgn

TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 13 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/223
REV. B

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B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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MTR

EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 德祐 AECOM

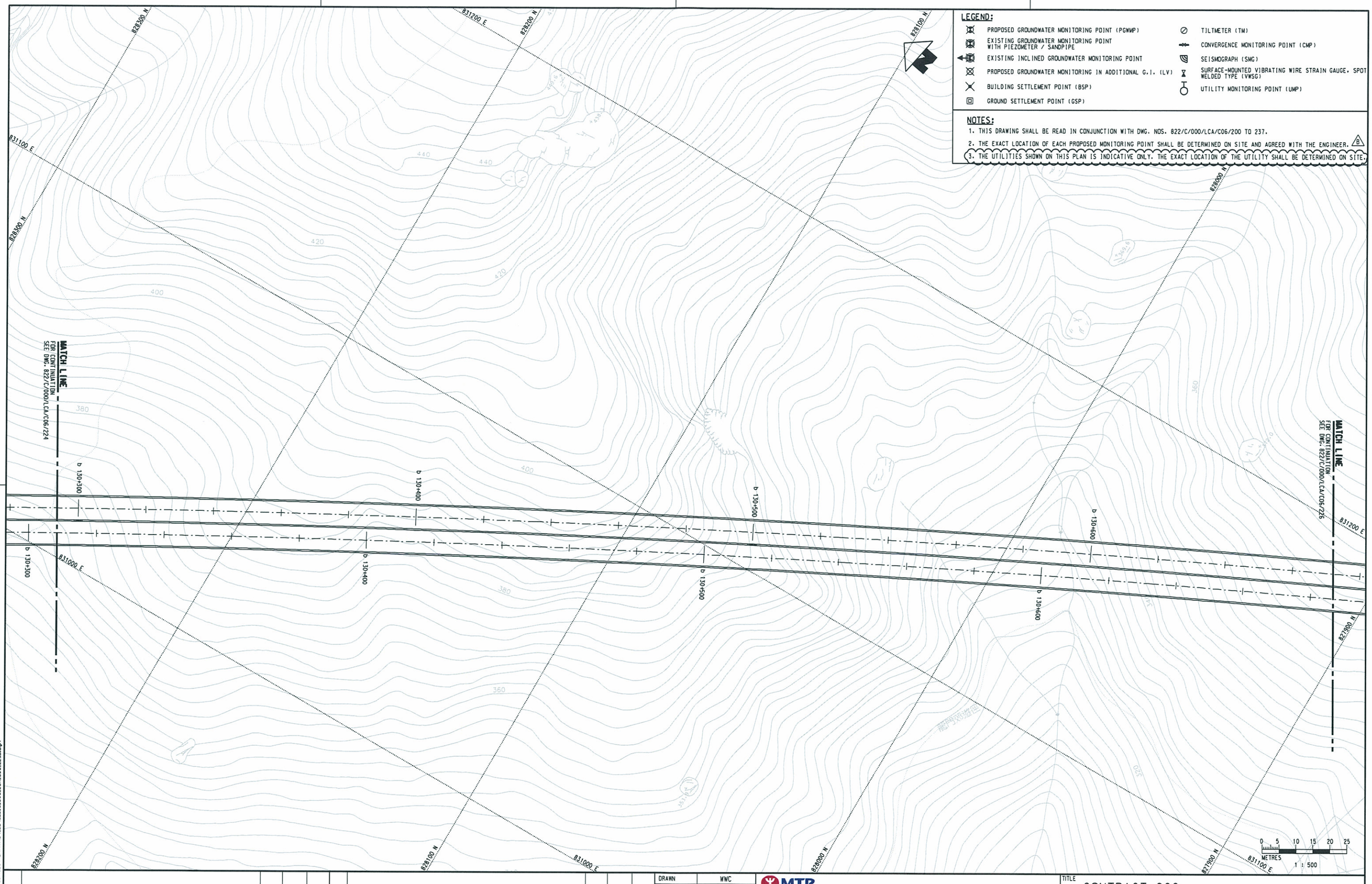
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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 14 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/224	B

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REV	DESCRIPTION	BY	DATE	APPROVED
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A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 香港拉斯 AECOM

CADD REF. 822_C_000_LCA_C06_225B.dgn

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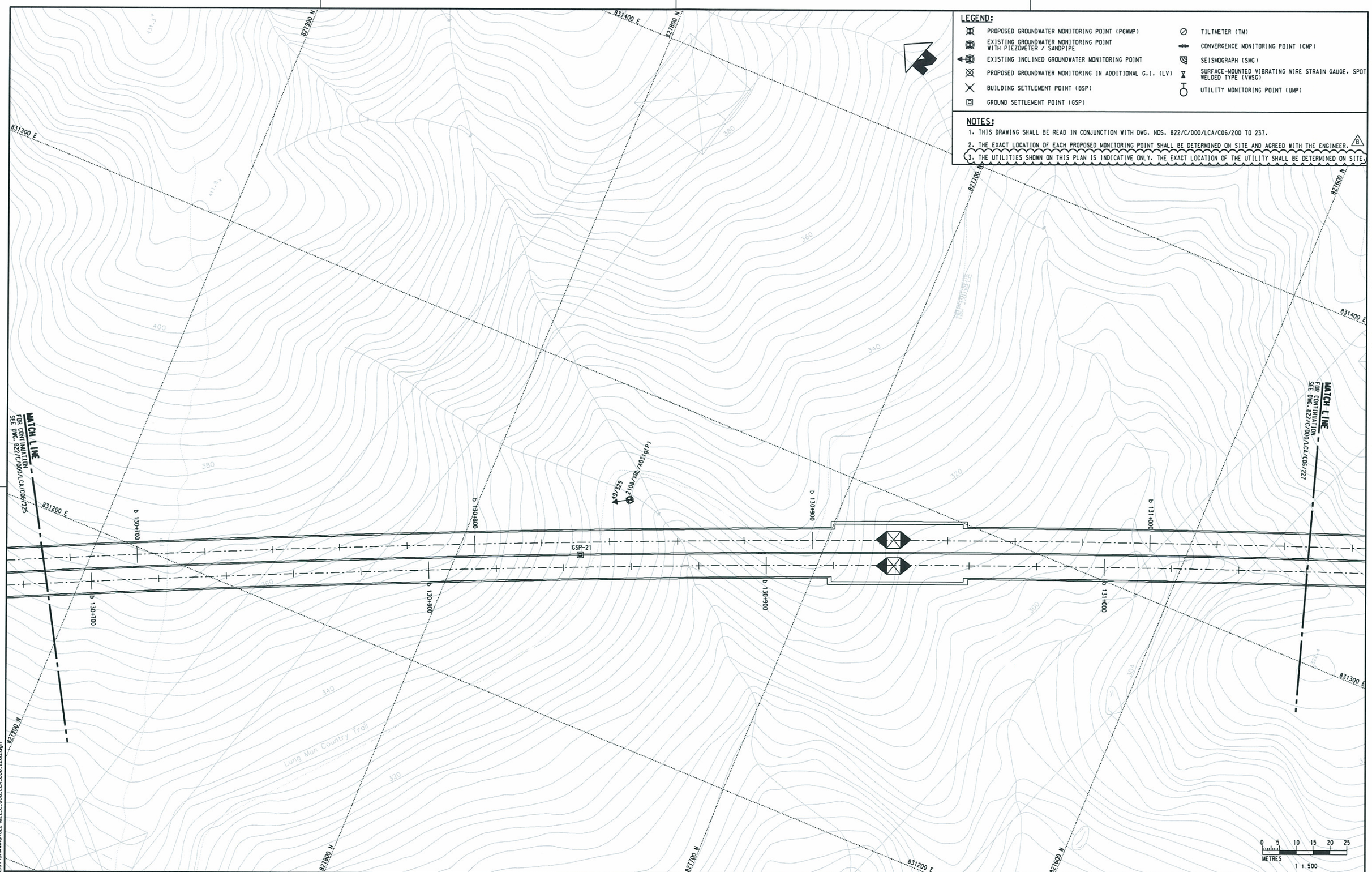
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 15 OF 27)

SCALE 1 : 500 (A1)

DRAWING NO. 822/C/000/LCA/C06/225

REV. B

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

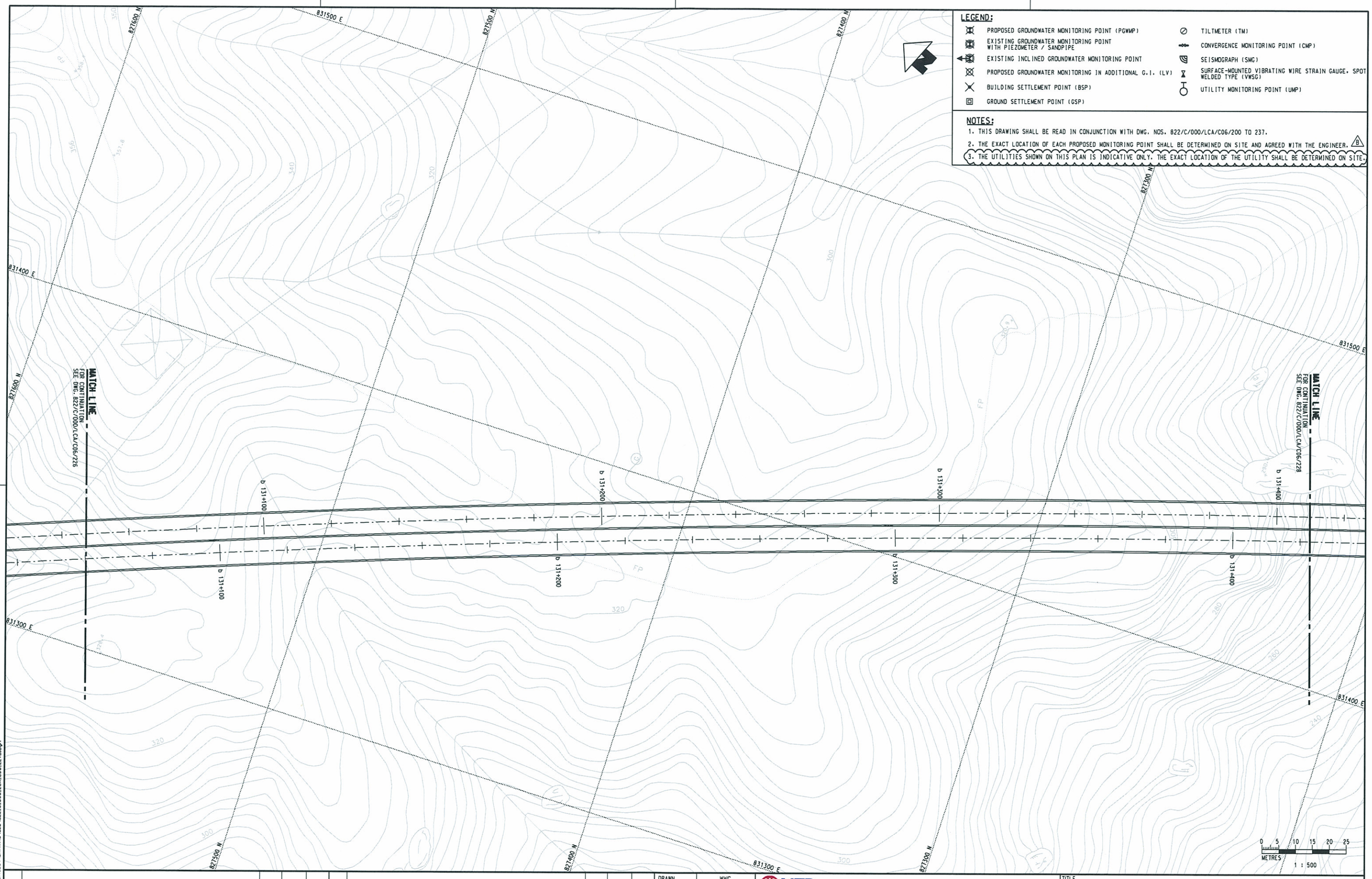
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EXPRESS RAIL LINK
ORIGINATOR
LEIGHTON 怡builder AECOM
CADD REF. 822_C_000_LCA_C06_226B.dgn

TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 16 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/226
REV. B

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PRINTED BY: WENY
200-5-20
14:58:40



LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER. B
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

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REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 禮頓 AECOM

CADD REF. 822_C_000_LCA_C06_227B.dgn

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 17 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/227	B

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER. B
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

831600 E
827100 N
827000 N
826900 N
831500 E
831400 E
827200 N

TSUEN WAN DRAINAGE TUNNEL (UNDER CONSTRUCTION)

THE PROPOSED INSTRUMENTATION FOR TSUEN WAN DRAINAGE TUNNEL SHALL BE AGREED WITH DSD.

MATCH LINE
FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/227

MATCH LINE
FOR CONTINUATION SEE DWG. 822/C/000/LCA/C06/229

b 131+400
b 131+500
b 131+600
b 131+700
b 131+800

GSP-22
CMP-1
VWSG-1
VWSG-2
CMP-2

0 5 10 15 20 25
METRES
1 : 500

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PRINTED BY: WCW7 2010-5-20 14:59:44

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A	FIRST DRAFT	TTHK	170310	JLY

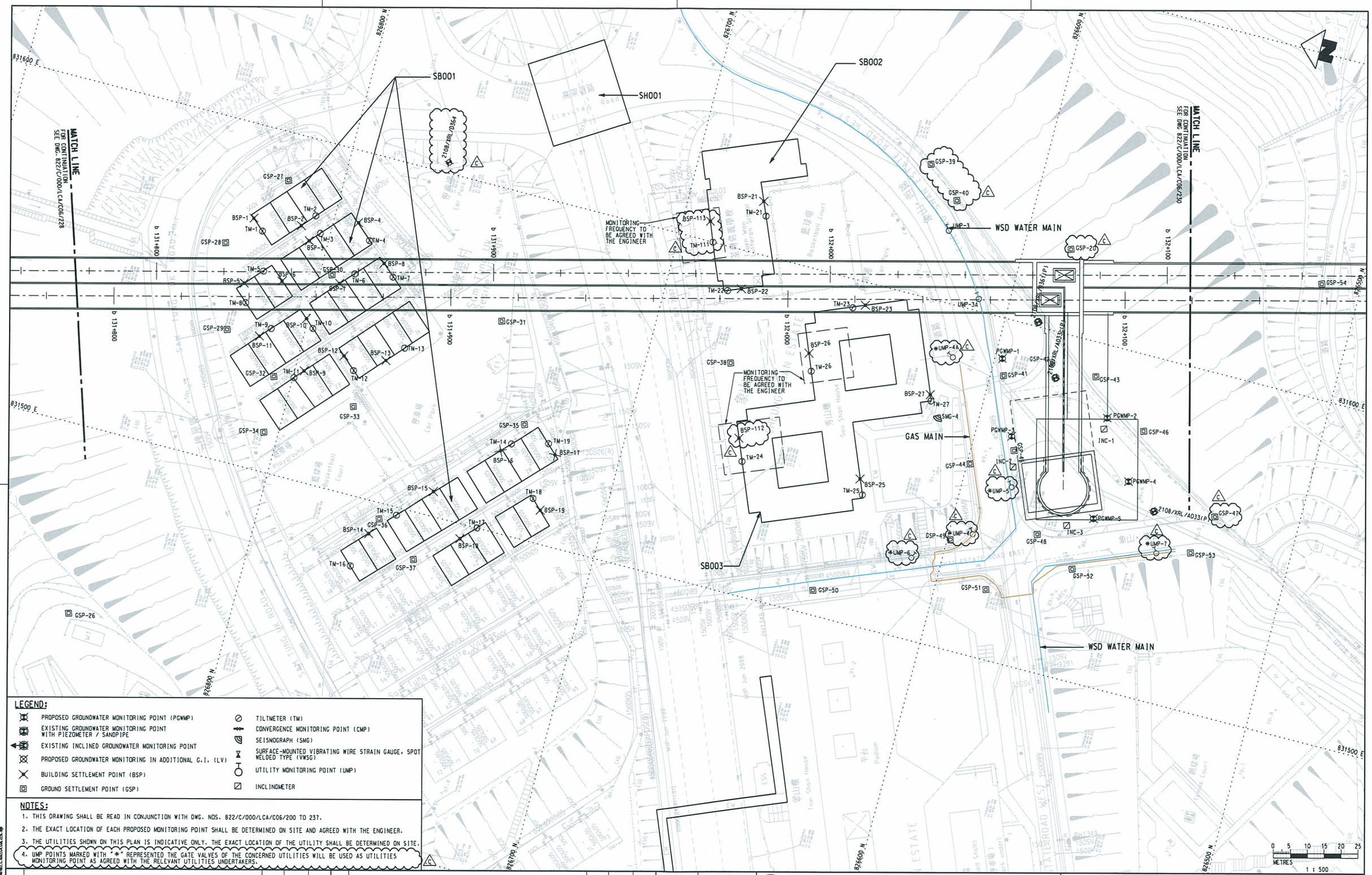
DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK
ORIGINATOR
LEIGHTON 陸訊 AECOM
CADD REF. 822_C_000_LCA_C06_228B.dgn

TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 18 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/228
REV. B



LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.
4. UMP POINTS MARKED WITH '*' REPRESENTED THE GATE VALVES OF THE CONCERNED UTILITIES WILL BE USED AS UTILITIES MONITORING POINT AS AGREED WITH THE RELEVANT UTILITIES UNDERTAKERS.

REV	DESCRIPTION	BY	DATE	APPROVED
C	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR

LEIGHTON 德祐 AECOM

CADD REF. $FILES$

TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 19 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/229	C

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / SANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL O.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER B

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER. B
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.

THE PROPOSED INSTRUMENTATION FOR TSUEN WAN NO. 2 FRESH WATER SERVICE RESERVOIR SHALL BE AGREED WITH WSD.

SB004

WSD WATER MAINS

MATCH LINE FOR CONTINUATION SEE DWG 822/C/000/LCA/C06/229

MATCH LINE FOR CONTINUATION SEE DWG 822/C/000/LCA/C06/231

REV	DESCRIPTION	BY	DATE	APPROVED
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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EXPRESS RAIL LINK

ORIGINATOR: LEIGHTON 禮頓 AECOM

CADD REF. 822_C_000_LCA_C06_230B.dgn

TITLE

CONTRACT 822

TSE UK TSUEN TO SHEK YAM TUNNELS

INSTRUMENTATION AND MONITORING PLAN

(SHEET 20 OF 27)

SCALE 1 : 500 (A1)

DRAWING NO. 822/C/000/LCA/C06/230

REV. B

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PRINTED BY: ZHANXL
PRINTED AT: 2010-5-24 14:32:07
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LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
2. THE EXACT LOCATION OF EACH PROPOSED MONITORING POINT SHALL BE DETERMINED ON SITE AND AGREED WITH THE ENGINEER.
3. THE UTILITIES SHOWN ON THIS PLAN IS INDICATIVE ONLY. THE EXACT LOCATION OF THE UTILITY SHALL BE DETERMINED ON SITE.
4. UMP POINTS MARKED WITH "*" REPRESENTED THE GATE VALVES OF THE CONCERNED UTILITIES WILL BE USED AS UTILITIES MONITORING POINT AS AGREED WITH THE RELEVANT UTILITIES UNDERTAKERS.

D

SB005 SB006 SB007

GSP-64 GSP-65 GSP-66 GSP-67 GSP-68 GSP-69 GSP-70 GSP-71 GSP-72 GSP-73 GSP-74 GSP-75 GSP-76 GSP-77 GSP-78 GSP-79 GSP-80 GSP-81

BSP-26 BSP-29 BSP-30 BSP-31 BSP-32 BSP-34 BSP-35 BSP-36 BSP-37 BSP-38 BSP-39 BSP-41 BSP-42 BSP-43 BSP-44 BSP-45 BSP-46 BSP-47 BSP-48 BSP-49 BSP-50 BSP-51 BSP-52

TM-28 TM-29 TM-30 TM-31 TM-32 TM-33 TM-34 TM-35 TM-36 TM-37 TM-38 TM-40 TM-41 TM-42 TM-43 TM-44 TM-45 TM-46 TM-47 TM-48 TM 49 TM 50

PGWMP-11

UMP-12 UMP-13 UMP-14 UMP-15 UMP-16 UMP-17 UMP-18 UMP-19 UMP-20

WSD WATER MAINS

2108/XRL/0356(P) 2108/XRL/0357 2108/XRL/0358(P) 2108/XRL/0359(P) 2108/XRL/A036(P)

b 132+400 b 132+500 b 132+600 b 132+700

826800 N 826900 N 827000 N 827100 N 827200 N 827300 N

831800 E 831900 E 831700 E

MATCH LINE
FOR CONTINUATION
SEE DWG 822/C/000/LCA/C06/230

MATCH LINE
FOR CONTINUATION
SEE DWG 822/C/000/LCA/C06/232

MATCH LINE
FOR CONTINUATION
SEE DWG 822/C/000/LCA/C06/233

REV	DESCRIPTION	BY	DATE	APPROVED
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
C	AS SHOWN	TTHK	040510	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

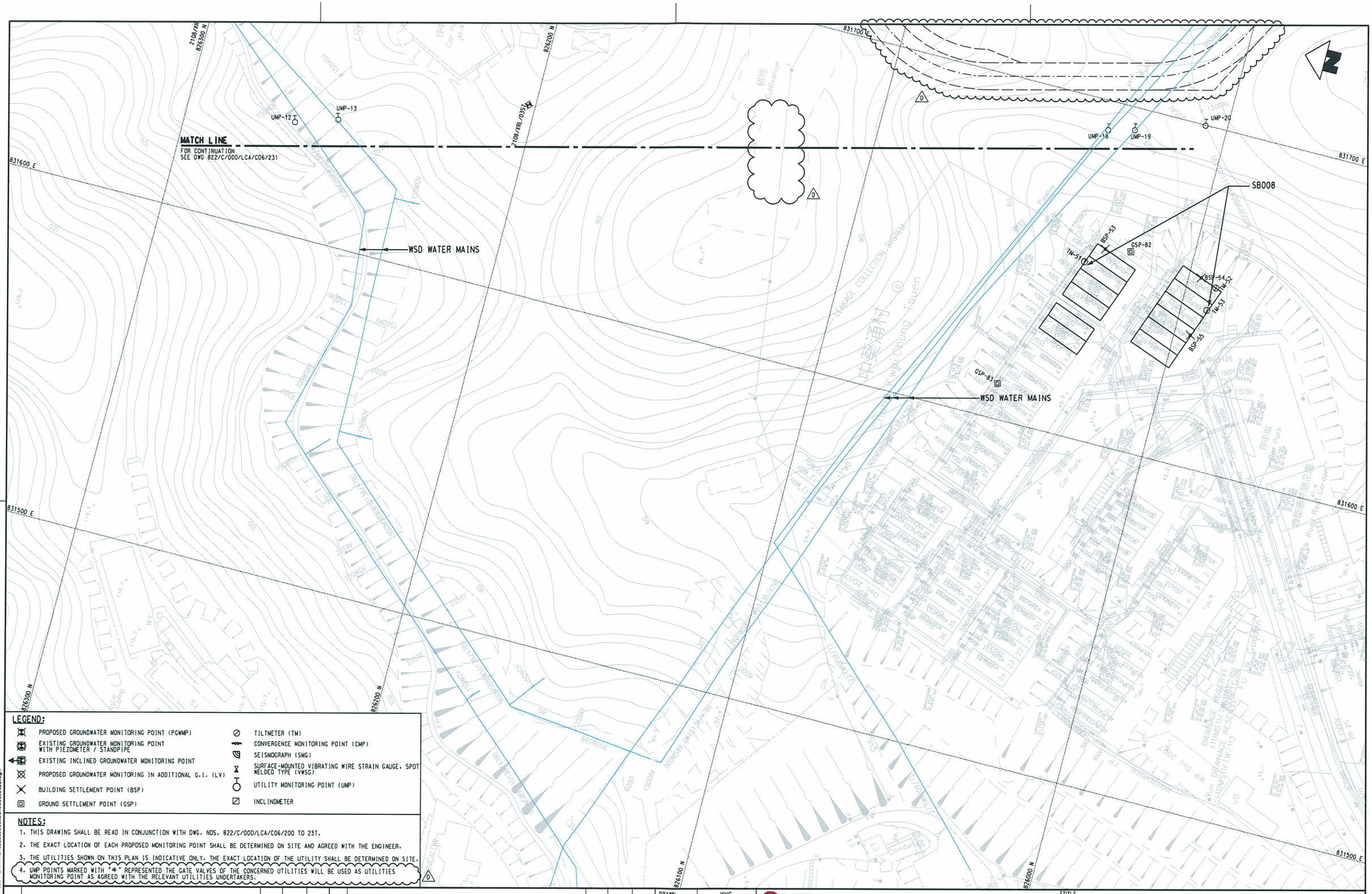
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MTR
EXPRESS RAIL LINK
ORIGINATOR
LEIGHTON 怡工 AECOM
CADD REF. 822_C_000_LCA_C06_231D.dgn

TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 21 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/231
REV. D

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FILENAME: P:\PROJECTS\6040936\DRAWINGS\822_C_000_LCA_C06_230.dgn
PRINTED BY: ZENGSY
2010-8-10 10:49:39



LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
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REV	DESCRIPTION	BY	DATE	APPROVED
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
C	AS SHOWN	TTHK	040510	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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LEIGHTON 禮頓 AECOM
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TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 22 OF 27)

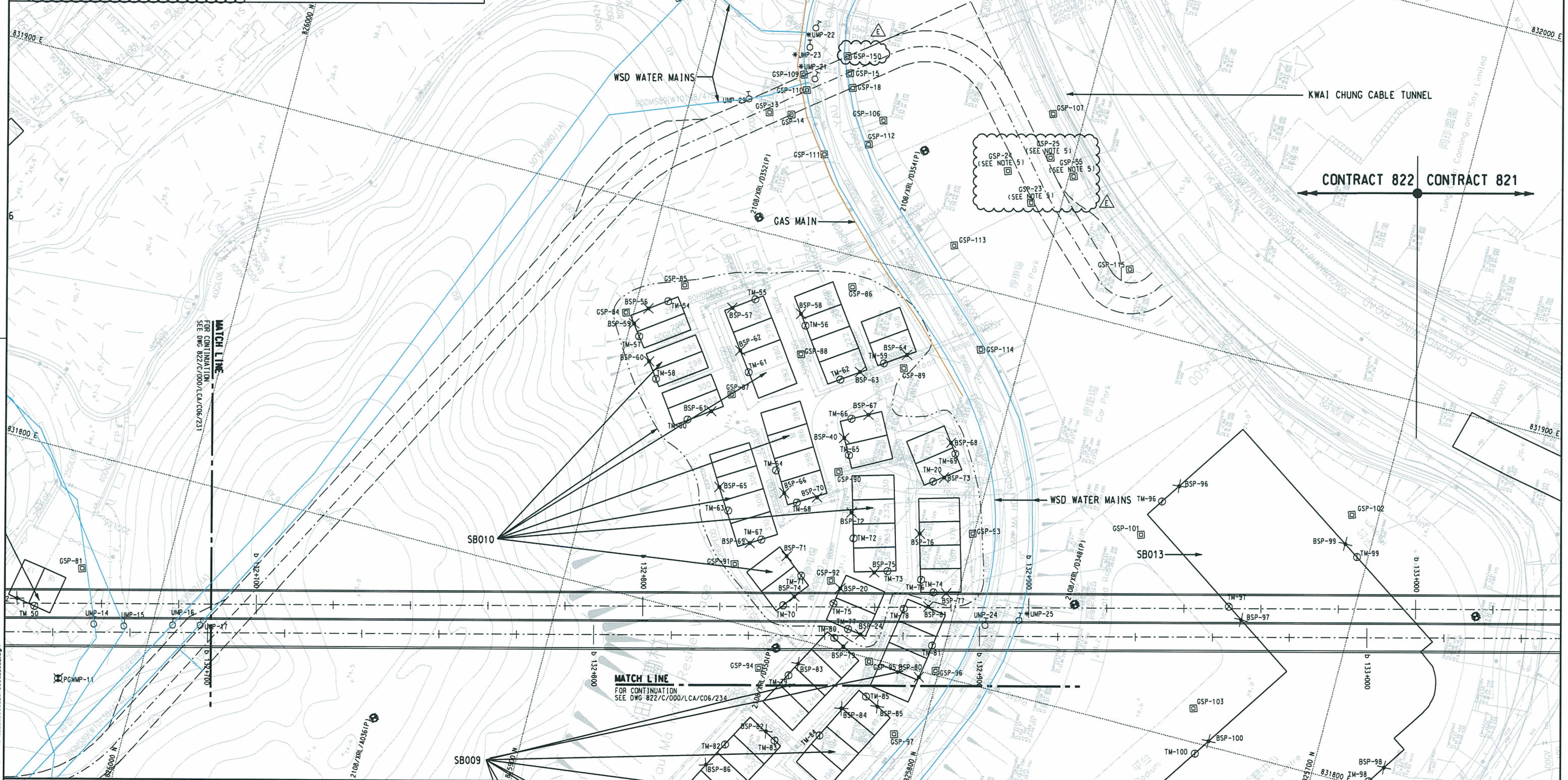
SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/232	D

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
- BUILDING SETTLEMENT POINT (BSP)
- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

NOTES:

1. THIS DRAWING SHALL BE READ IN CONJUNCTION WITH DWG. NOS. 822/C/000/LCA/C06/200 TO 237.
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5. GSP TO BE INSTALLED FOR THE TEMPORARY CONCRETE BLOCKS. (E)



REV	DESCRIPTION	BY	DATE	APPROVED
E	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	120810	JLY
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
C	AS SHOWN	TTHK	040510	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	170310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

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TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 23 OF 27)

SCALE 1 : 500 (A1) | DRAWING NO. 822/C/000/LCA/C06/233 | REV. E

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CONTRACT 822 CONTRACT 821

SB010

SB009

SB011

SB012

SB013

SB014

SB015

SB016

SH002

MATCH LINE
FOR CONTINUATION
SEE DWG 822/C/000/LCA/C06/233

WSD WATER MAINS

EBS NO. SB012 HAS BEEN DEMOLISHED AND THE AREA IS CURRENTLY UNDER CONSTRUCTION. HENCE INSTALLATION OF INSTRUMENT NOS. TM-93, 94 AND BSP-94, 95 OR ADDITIONAL INSTRUMENT ARE SUBJECTED TO THE CONSTRUCTION ACTIVITY OF THE AREA IN RELATION TO XRL TUNNEL CONSTRUCTION WORKS.

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
- PROPOSED GROUNDWATER MONITORING IN ADDITIONAL G.I. (LV)
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- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

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REV	DESCRIPTION	BY	DATE	APPROVED
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	230710	JLY
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DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	17/MAR/2010

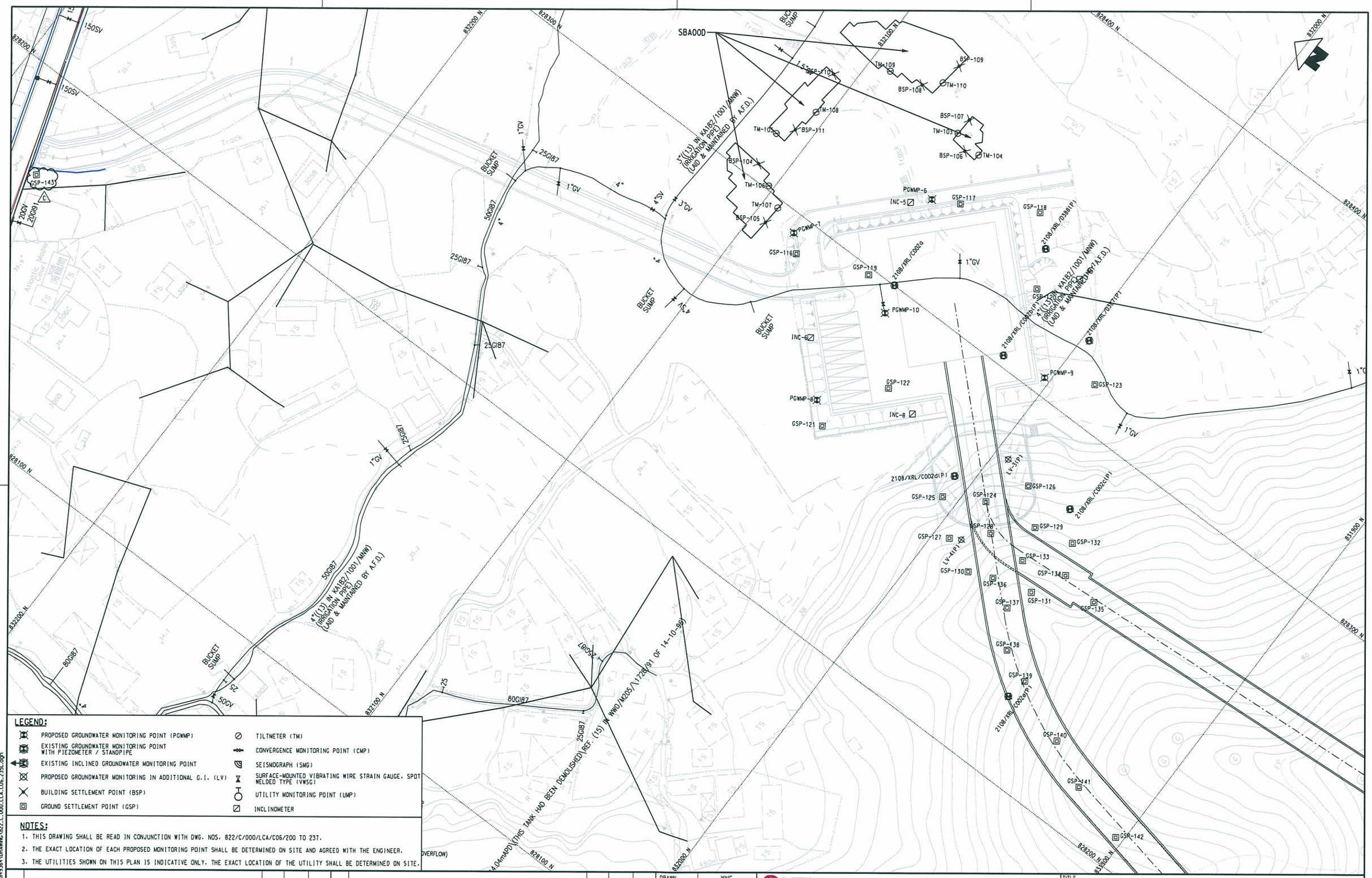
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TITLE
CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 24 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/234
REV. D

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FILENAME: P:\PROJECTS\GDM9364\DRAWING\822_C_000_LCA_C06_234D.dgn
PRINTED BY: ZENGSY
2010-8-10 10:48:22



LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
- EXISTING INCLINED GROUNDWATER MONITORING POINT
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- GROUND SETTLEMENT POINT (GSP)
- TILTMETER (TM)
- CONVERGENCE MONITORING POINT (CMP)
- SEISMOGRAPH (SMG)
- SURFACE-MOUNTED VIBRATING WIRE STRAIN GAUGE, SPOT WELDED TYPE (VWSG)
- UTILITY MONITORING POINT (UMP)
- INCLINOMETER

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REV	DESCRIPTION	BY	DATE	APPROVED
C	ISSUE FOR APPROVAL	TTHK	170810	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	230310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	23/MAR/2010

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ORIGINATOR

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TITLE

CONTRACT 822
TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 25 OF 27)

SCALE	DRAWING NO.	REV.
1 : 500 (A1)	822/C/000/LCA/C06/235	C

LEGEND:

- PROPOSED GROUNDWATER MONITORING POINT (PGWMP)
- EXISTING GROUNDWATER MONITORING POINT WITH PIEZOMETER / STANDPIPE
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SO KWUN WAT SITE FORMATION WORKS DETAIL SHALL REFER TO SITE FORMATION DRAWINGS.

ABANDONED DUE TO CONSTRUCTION ACTIVITIES

2108/XRL/A082(P)

2108/XRL/A081(P)

2108/XRL/A080(P)

GSP-148

GSP-147

GSP-146

LV-5(P)

TURNING CIRCLE FOR MINES DELIVERY VEHICLES

EXISTING FEATURE NO. 6SW-D/C221

EXISTING FEATURE NO. 6SW-D/C219

EXISTING FEATURE NO. 6SW-D/C214

EXISTING FEATURE NO. 6SW-D/C215

ACCESS TO NAM WAN TSAI STREET

N 825900 N 825950 E 819050 E 819100

0 2 4 6 8 10 METRES

1 : 200

MINIMUM FREQUENCY OF MONITORING FOR PIEZOMETER LV-5

INSTRUMENT	DURING TRIMMING WORKS OF FEATURE NO. 6SW-D/C214	DURING WET SEASON	DURING DRY SEASON
LV-5	TWICE A WEEK	WEEKLY	B1-WEEKLLY

MINIMUM FREQUENCY OF MONITORING FOR GROUND SETTLEMENT POINT AT FEATURE NO. 6SW-D/C241 CREST

INSTRUMENT	BACKGROUD	DURING TRIMMING OF THE SLOPE	AFTER COMPLETION OF SITE FORMATION WORKS AROUND FEATURE
GSP-146,147 AND 148	WEEKLY	DAILY	CEASED *

* AFTER COMPLETION OF SITE FORMATION WORKS AROUND THE FEATURE, THE MONITORING OF GROUND SETTLEMENT POINT AT FEATURE NO. 6SW-D/C241 WILL BE CEASED

GENERALIZED PLAN OF ACTION FOR PIEZOMETER LV-5

RESPONSE LEVEL	RESPONSE VALUE	MINIMUM ACTION TO BE TAKEN
ALERT LEVEL	GROUNDWATER LEVEL REACHES +99mPD	- REVIEW MONITORING FREQENCY AND INCREASE THE FREQUENCY IF NECESSARY.
ACTION LEVEL	GROUNDWATER LEVEL REACHES +102.5mPD	- CARRY OUT DESIGN REVIEW FOR SUBMISSION TO RELEVANT PARTIES.
ALARM LEVEL	GROUNDWATER LEVEL REACHES +103mPD	- CARRY OUT ADDITIONAL UPGRADING WORKS DESIGN FOR SUBMISSION TO RELEVANT PARTIES FOR APPROVAL. - CARRY OUT ADDITIONAL UPGRADING WORKS IF PROPOSED UPGRADING WORKS APPROVED.

RESPONE VALUES FOR EXISTING DRILLHOLE NOS. A08D & A08Z SHALL REFER DRAWING NO. 822/C/000/LCA/C06/200

REV	DESCRIPTION	BY	DATE	APPROVED
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	220710	JLY
C	ISSUE FOR APPROVAL	TTHK	100610	JLY
B	ISSUE FOR APPROVAL	TTHK	190510	JLY
A	FIRST DRAFT	TTHK	230310	JLY

DRAWN	WWC
DESIGNED	TTHK
CHECKED	CYKC
APPROVED	JLY
DATE	23/MAR/2010

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ORIGINATOR

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TITLE

CONTRACT 822

TSE UK TSUEN TO SHEK YAM TUNNELS

INSTRUMENTATION AND MONITORING PLAN

(SHEET 26 OF 27)

SCALE	DRAWING NO.	REV.
1 : 200 (A1)	822/C/000/LCA/C06/236	D

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MINIMUM FREQUENCY OF MONITORING FOR GSP-144, GSP-145 AND GSP-149 (D)

INSTRUMENT	MINIMUM FREQUENCY OF MONITORING	
	BACKGROUND MONITORING	DURING BARGING POINT OPERATION
GSP-144, GSP-145 & GSP-149 (D)	WEEKLY	WEEKLY *

* THE FREQUENCY SHALL BE REVIEWED IF THERE IS NO CONTINUOUS MOVEMENT FOR ONE YEAR AFTER THE OPERATION OF BARGING POINT

RESPONSE LEVELS FOR GSP-144, GSP-145 AND GSP-149 (D)

STRUCTURE	ALERT	ACTION	ALARM
GROUND SETTLEMENT AT SEAWALL	25mm OR 1:600 (D)	40mm OR 1:375 (D)	50mm OR 1:300 (D)

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821900 E
821800 E
821700 E
822400 N
822300 N
822000 E

青洲灣
TSING CHAU WAN

TSING CHAU WAN WORKS AREAS (PS APPENDIX F1-7)

GSP-144
GSP-145
GSP-149 (D)

HWM
Rubble
碎石
Seawall
海堤
Outfall
排污口
MTR (Airport Express)
Tunnel
隧道
Road
道路
CUL
HL

0 5 10 15 20 25
METRES
1 : 500

REV	DESCRIPTION	BY	DATE	APPROVED
D	ISSUE FOR APPROVAL (INCORPORATED MTRC'S COMMENTS)	TTHK	220710	JLY
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TITLE
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TSE UK TSUEN TO SHEK YAM TUNNELS
INSTRUMENTATION AND MONITORING PLAN
(SHEET 27 OF 27)

SCALE 1 : 500 (A1)
DRAWING NO. 822/C/000/LCA/C06/237
REV. D

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PRINTED: 2010-7-22
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Flow Chart to the Contingency Actions for Groundwater Response Level

